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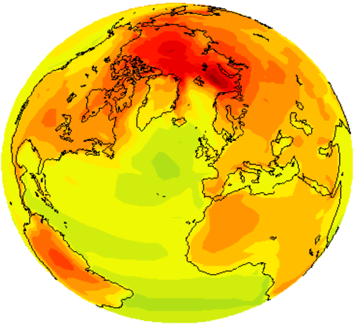

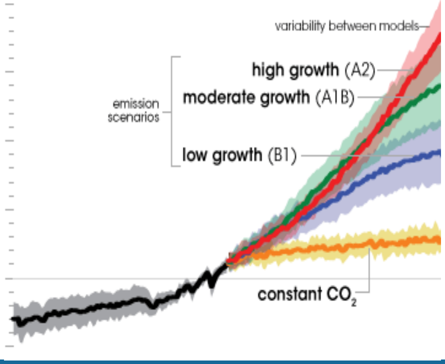

Climate-smart ecological restoration: framework and lesson learned from a coastal California stream

Thomas Gardali, Nathaniel E. Seavy, John J. Parodi, Leia Giambastiani, and Stephanie C. Nelson

April 2013 - *National Adaptation Forum, Denver, CO*

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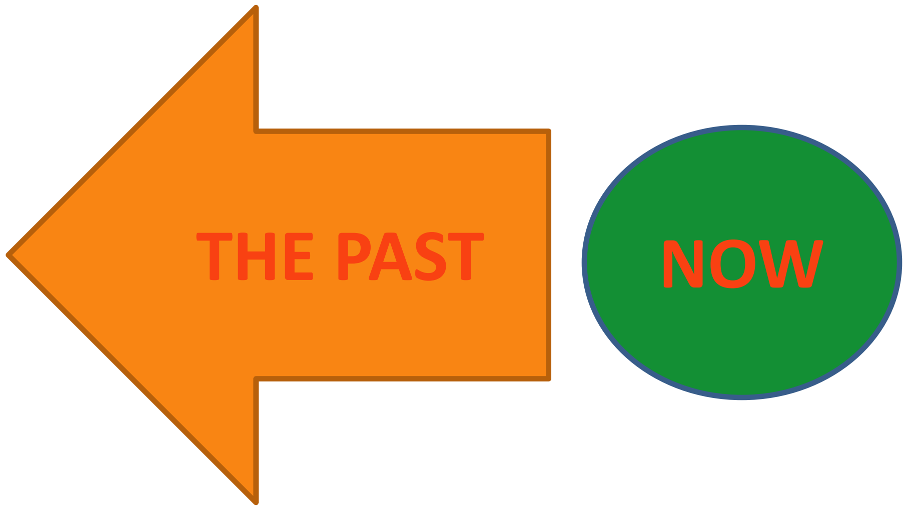
Presentation Outline

1. Restoration Ecology
2. Climate-smart ecological restoration defined
3. Climate-smart ecological restoration principles
4. Principles to practice
5. Case study – lesson learned

Ecological Restoration



Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration 2004)

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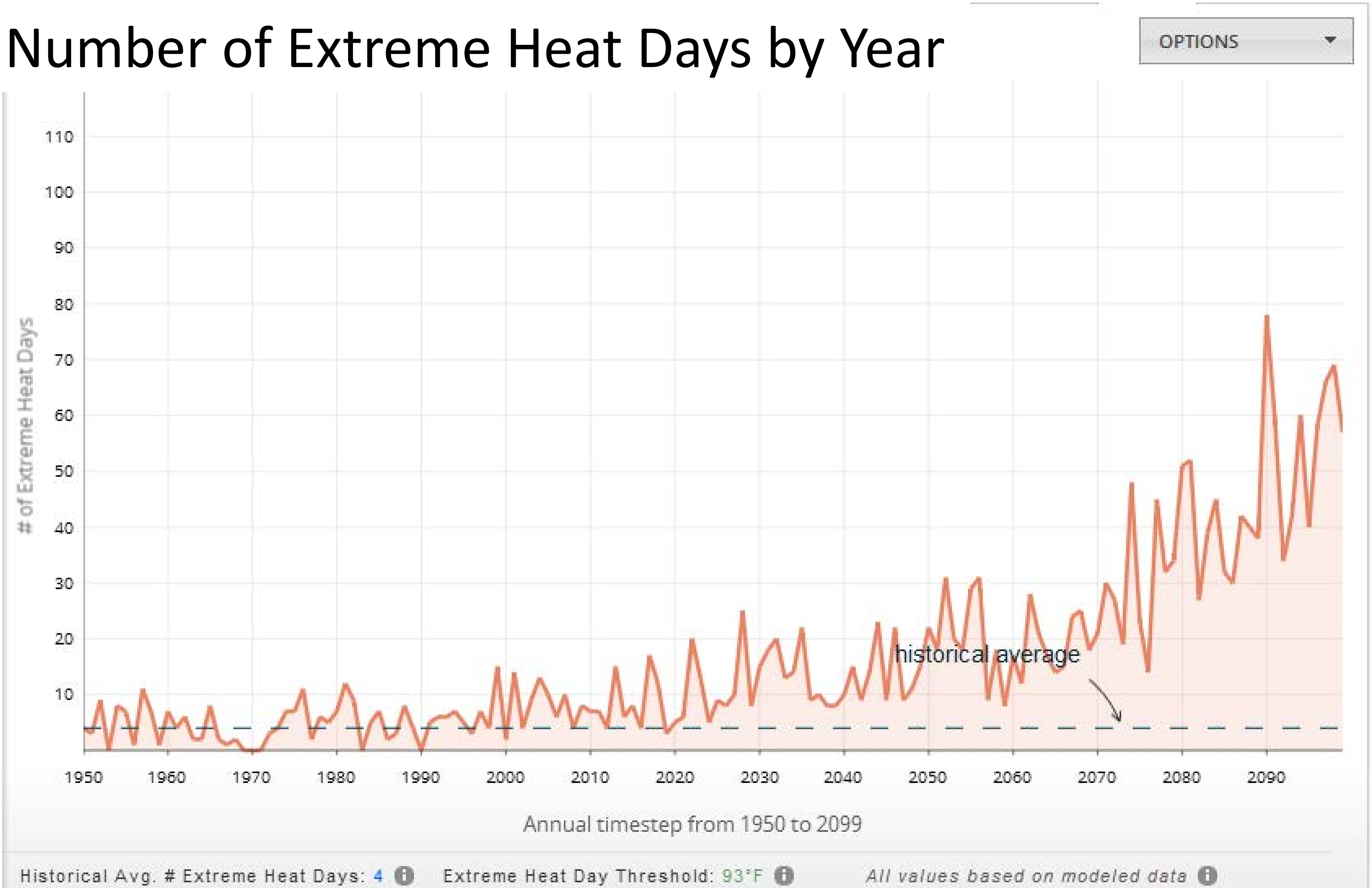
Climate Change: Restoration Game Changer



Source: http://cal-adapt.org/

Climate-smart Ecological Restoration defined

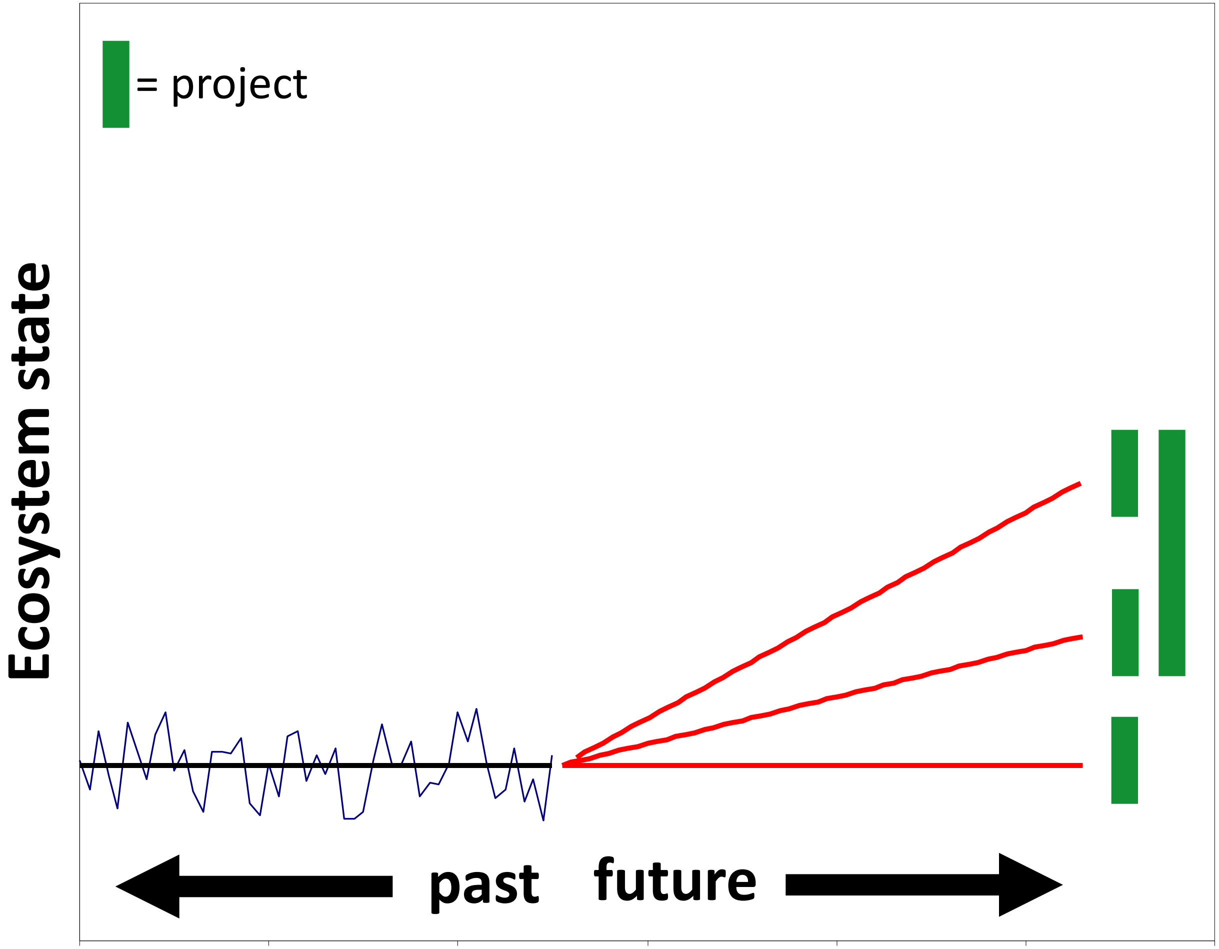
Climate-smart ecological restoration is the process of enhancing ecological function of degraded, damaged, or destroyed areas in a manner that prepares them for the consequences of a rapidly changing climate.

Climate-smart Ecological Restoration Principles

1. **Look forward but don't ignore the past**
   - *Forward looking goals, use climate predictions, historic analogs*
2. **Consider the broader context**
   - *Landscape, non-climate threats, prioritization*
3. **Build in ecological insurance**
   - *Redundancies, ecological diversity*
4. **Build evolutionary resilience**
   - *Increase size/connectedness, source seeds from other regions*
5. **Include the human community**
   - *To implement, monitor, steward*

Adapted from: http://www.nwf.org/, Palmer Est. & Coasts 32, Hansen et al. Con. Bio. 24

Principles in action



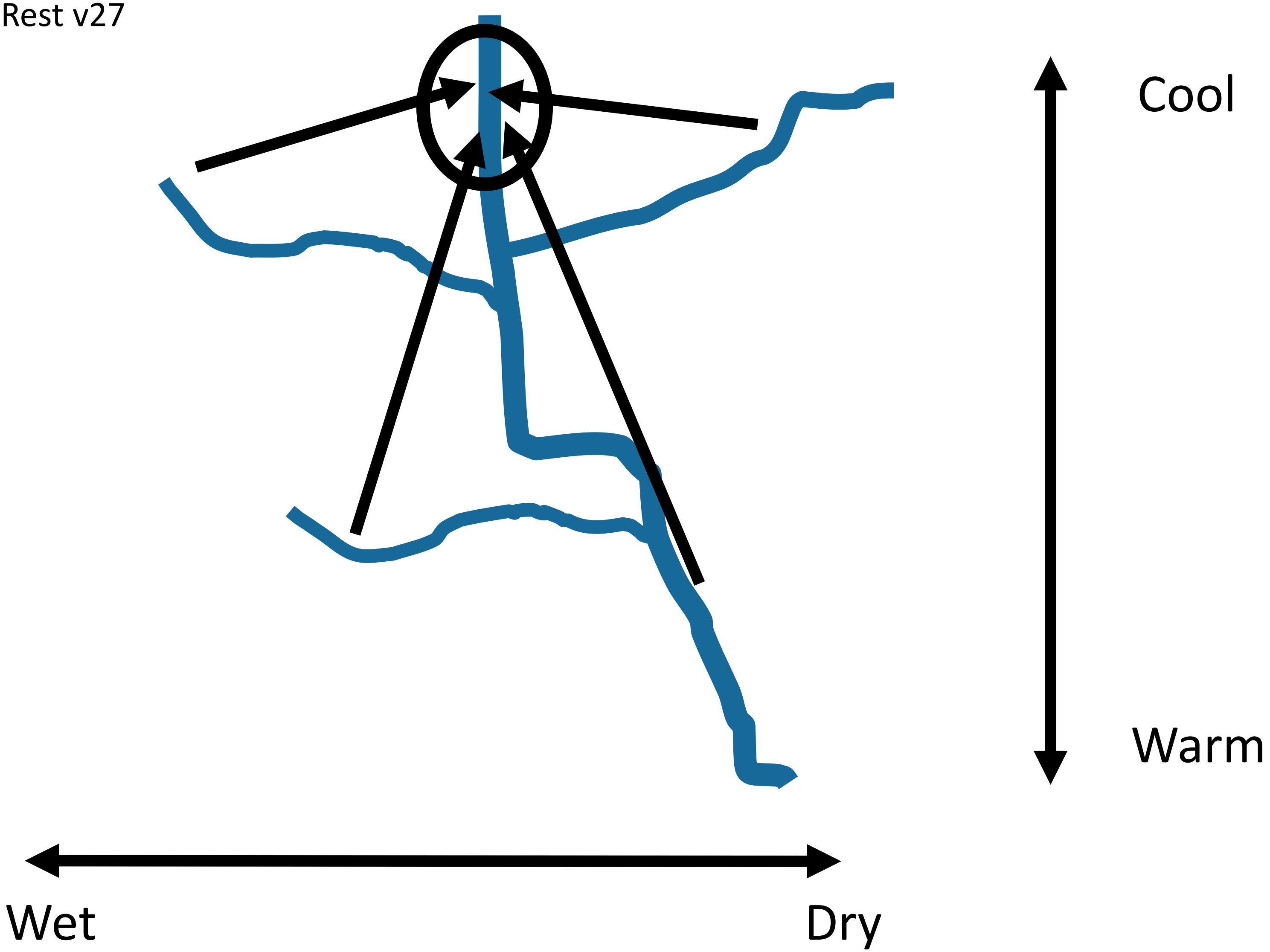
e.g., drought and floods

Prioritize and design projects that could succeed under multiple scenarios

Seavy et al., Ecol. Rest v27

Principles in action

Seavy et al., Ecol. Rest v27



Principles in action

Increase Component and Structural **Redundancy**

Dunwiddie et al., Ecol. Rest v27

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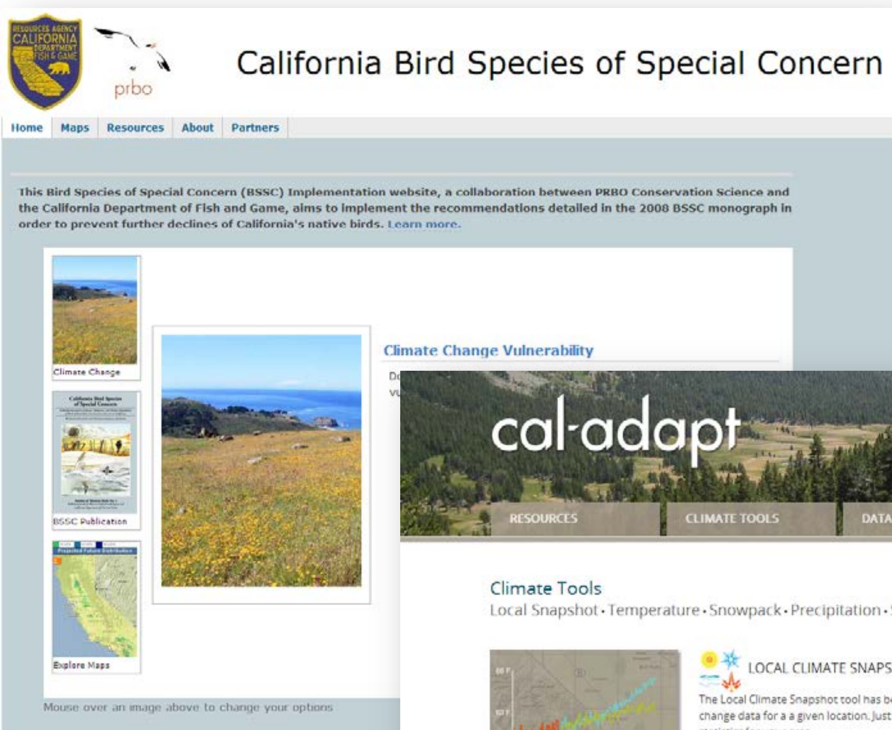
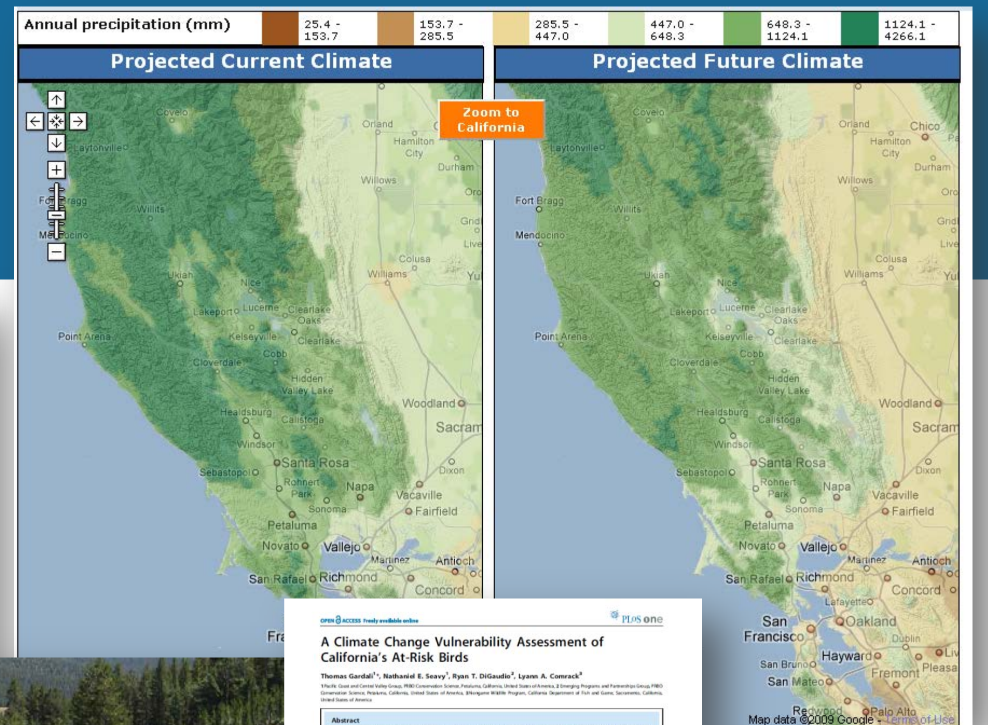
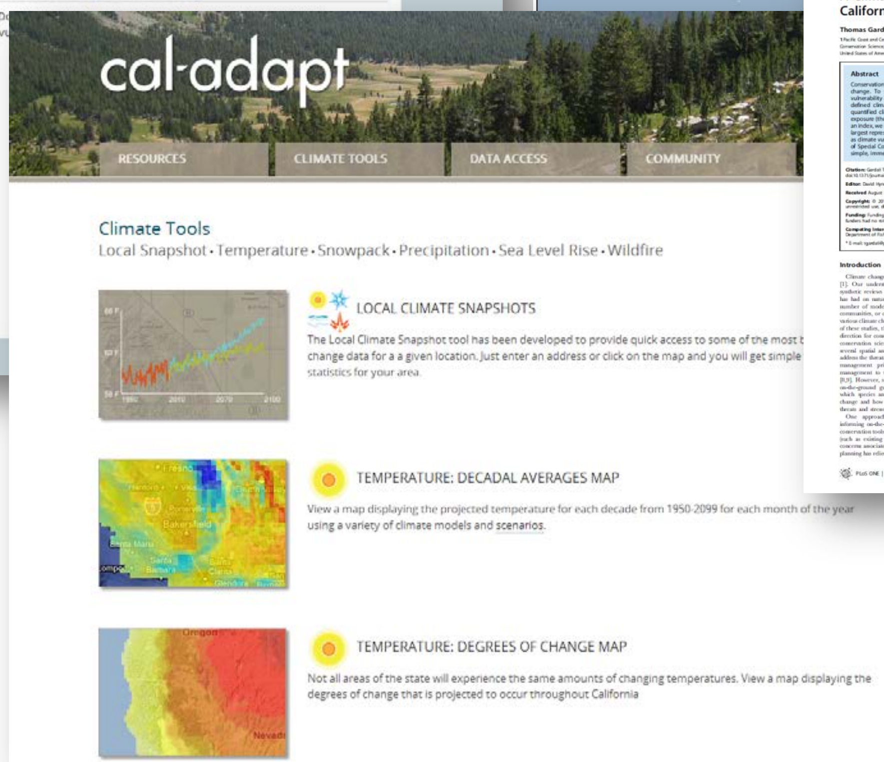
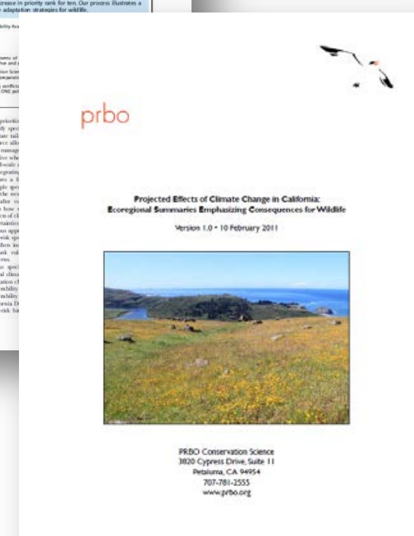
Principles in action









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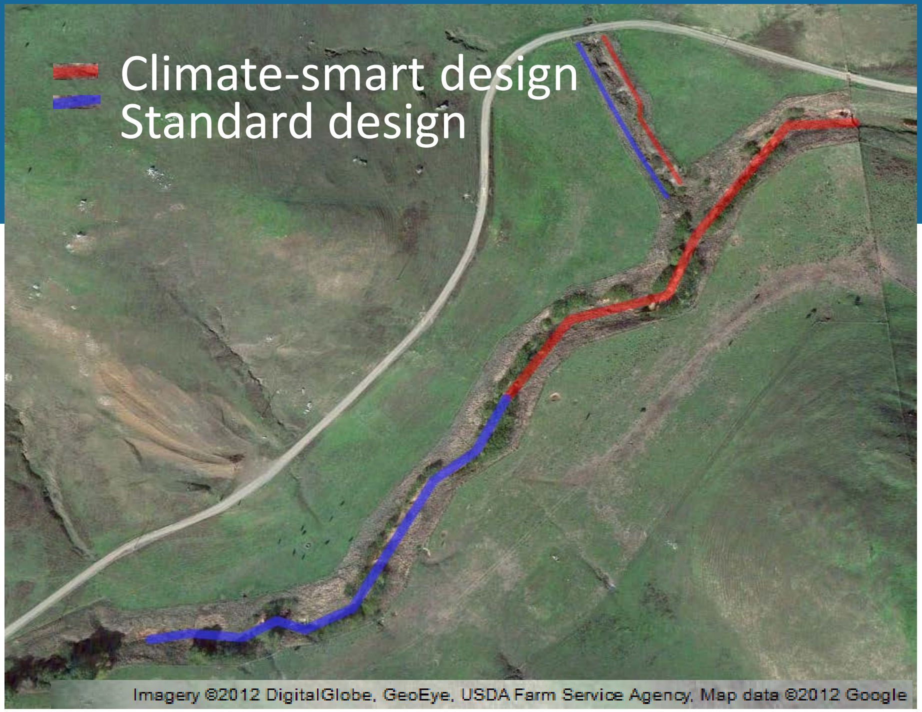
Project Description



- Riparian restoration (revegetation)
- 0.35 river miles
- Side-by-side comparison

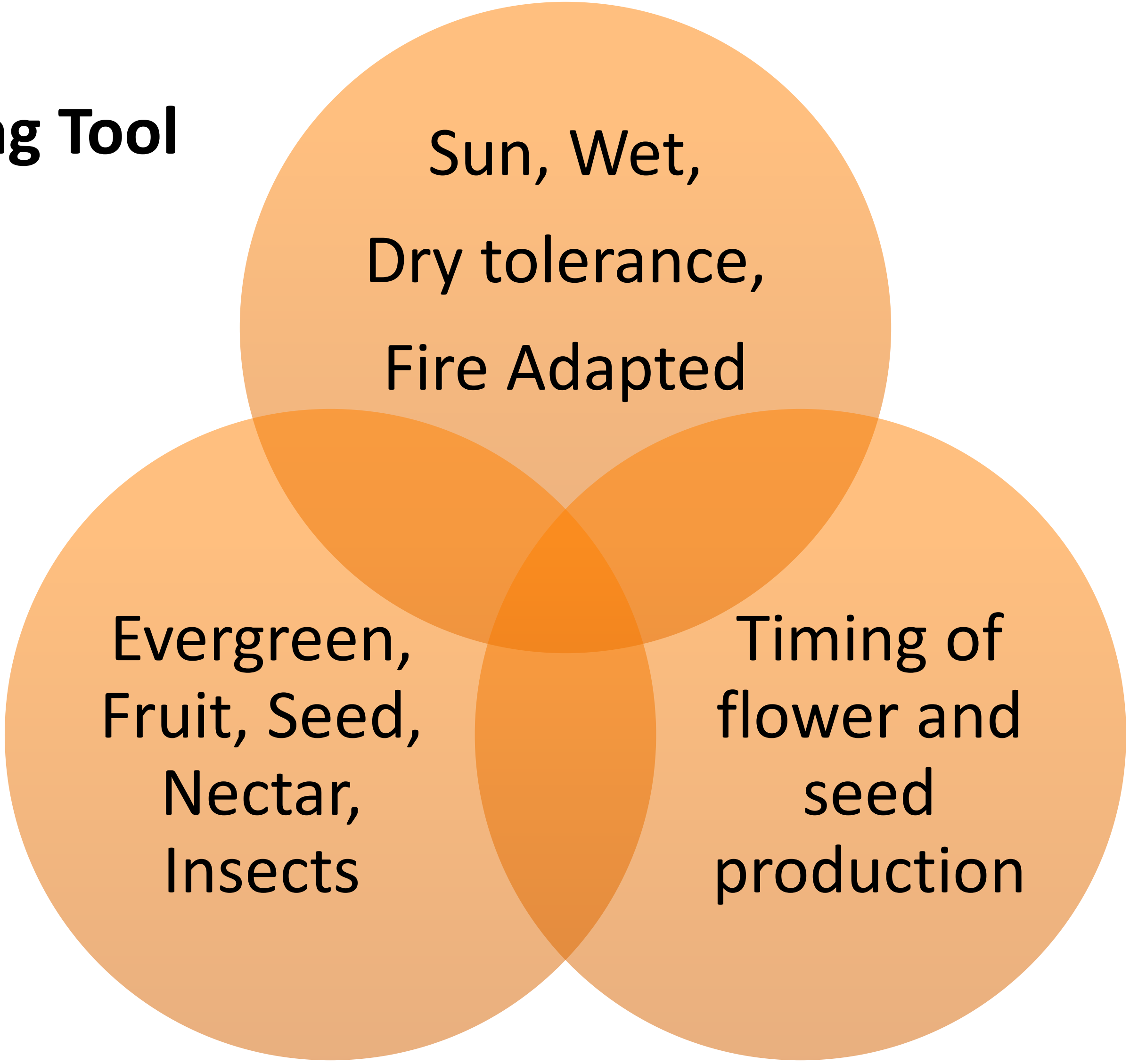
GOALS - water quality and wildlife habitat

(1) Reduce the vulnerability of the area to extreme weather events by increasing the capacity of the restoration to rebound from longer and/or more frequent periods of drought, floods, and to a lesser extent fire.

(2) Reduce the vulnerability of wildlife to phenological mismatches by increasing the number of months and the amount of resources (cover, food) available.

Practices on-the-ground

Simple Planting Tool



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Developed Planning Matrix

We created a tool to evaluate appropriate plant species and their environmental qualities

Common Name	Tolerates full or partial sun	Tolerates clay soil	Tolerates wet conditions	Tolerates dry conditions	Evergreen	Fire Adapted	Wildlife fruit source	Wildlife Nectar source	Wildlife Seed Source	Insectary Plant
Sticky manzanita	1		0	1	1	1	1	1		1
common manzanita	1	1	0	1	1	1	1	1		1
Bearberry	1	1	0	1	1	1	1	1		1
Marin manzanita	1		0	1	1	1	1	1		1
CA Sagebrush	1	1	0	1	1	1	0	1	1	1
Salt Marsh Baccharis	1	1	1	1	0					1
coyote brush	1	1	1	1	1	1	1	0	1	1
spice bush	1	1	1	1	0		0	0	0	1
Ceanothus	1			1	1	1	0	1	1	1
blue blossom	1		0	1	1	1	0	1	1	1
Mountain Mahogany	1	1	0	1	0	1	0	1	1	1
Creek dogwood	1	1	1	0	0		1	1	0	1
hazelnut	1	1	1	0	0		0	1	1	1
Hawthorne	1	1	1	1	0		1	1	1	1
Western leatherwood	1	1	1	0			1			
fremontia/ flannelbush	1	1	0	1	1	1	0	1	1	1
Toyon	1	1	0	1	1		1	1		
Creambush	1	1	1	1	0		0	1	1	1

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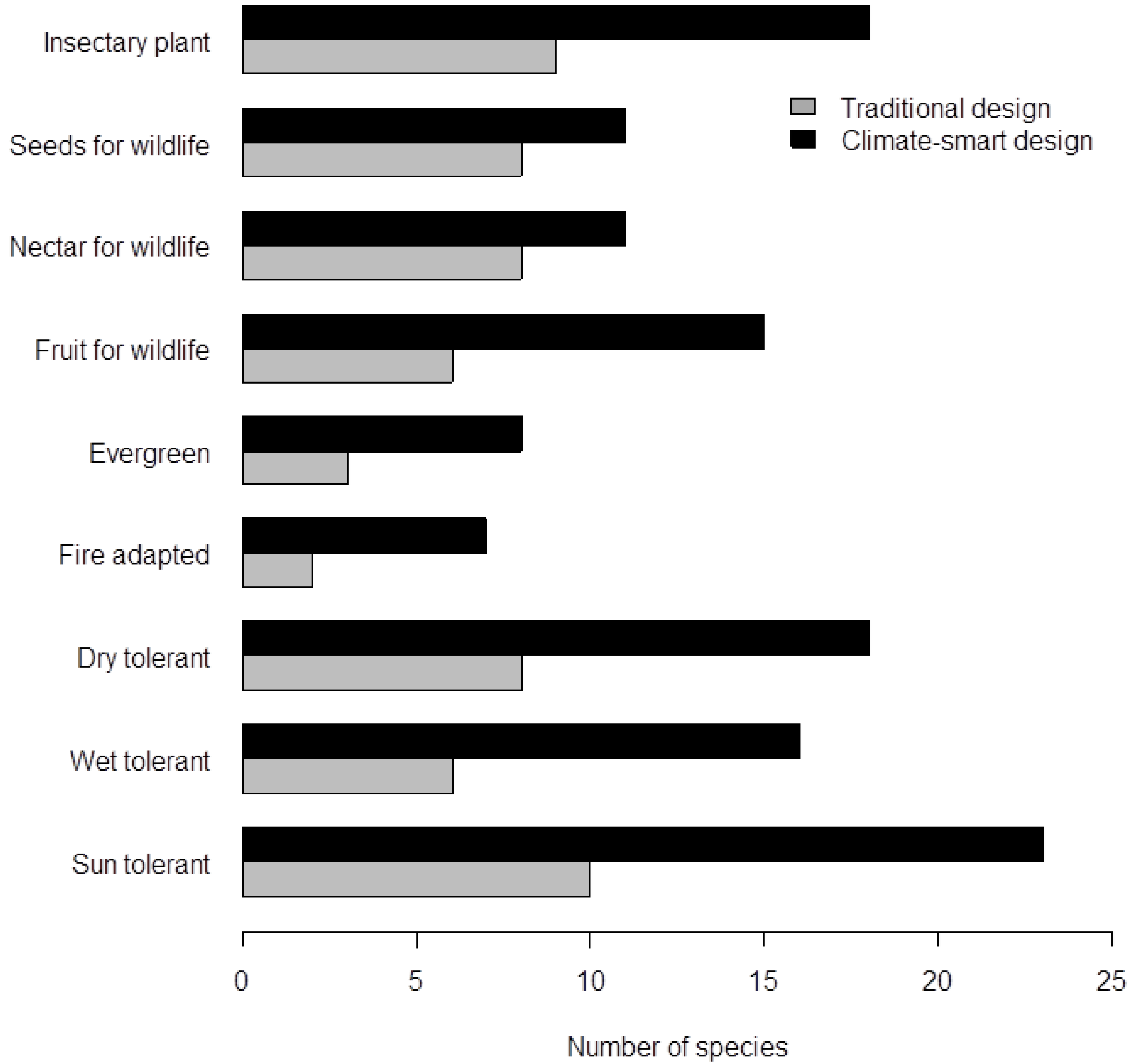
Developed Planning Matrix

And evaluated timing of flowering/seeding to maximize the number of months that resources (food) are available for wildlife

Common Name	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Sticky manzanita	1	1	1	1								
common manzanita	1		1	1	1						1	1
Bearberry			1	1	1	1						
Marin manzanita												
CA Sagebrush								1	1	1	1	1
Salt Marsh Baccharis							1	1	1	1		
coyote brush	1							1	1	1	1	1
spice bush				1	1	1	1	1				
Ceanothus			1	1	1							
blue blossom			1	1	1	1	1	1	1	1		
Mountain Mahogany			1	1	1							
Creek dogwood					1	1	1					
hazelnut	1	1	1	1				1	1	1		
Hawthorne				1	1							
Western leatherwood	1	1	1									
fremontia/ flannelbush					1	1	1					
Toyon						1	1			1	1	1
Creambush					1	1	1	1		1	1	
Pitcher Sage												


Insectary plant
Seeds for wildlife
Nectar for wildlife
Fruit for wildlife
Evergreen
Fire adapted
Dry tolerant
Wet tolerant
Sun tolerant
Traditional design
Climate-smart design
0
5
10
15
20
25
Number of species

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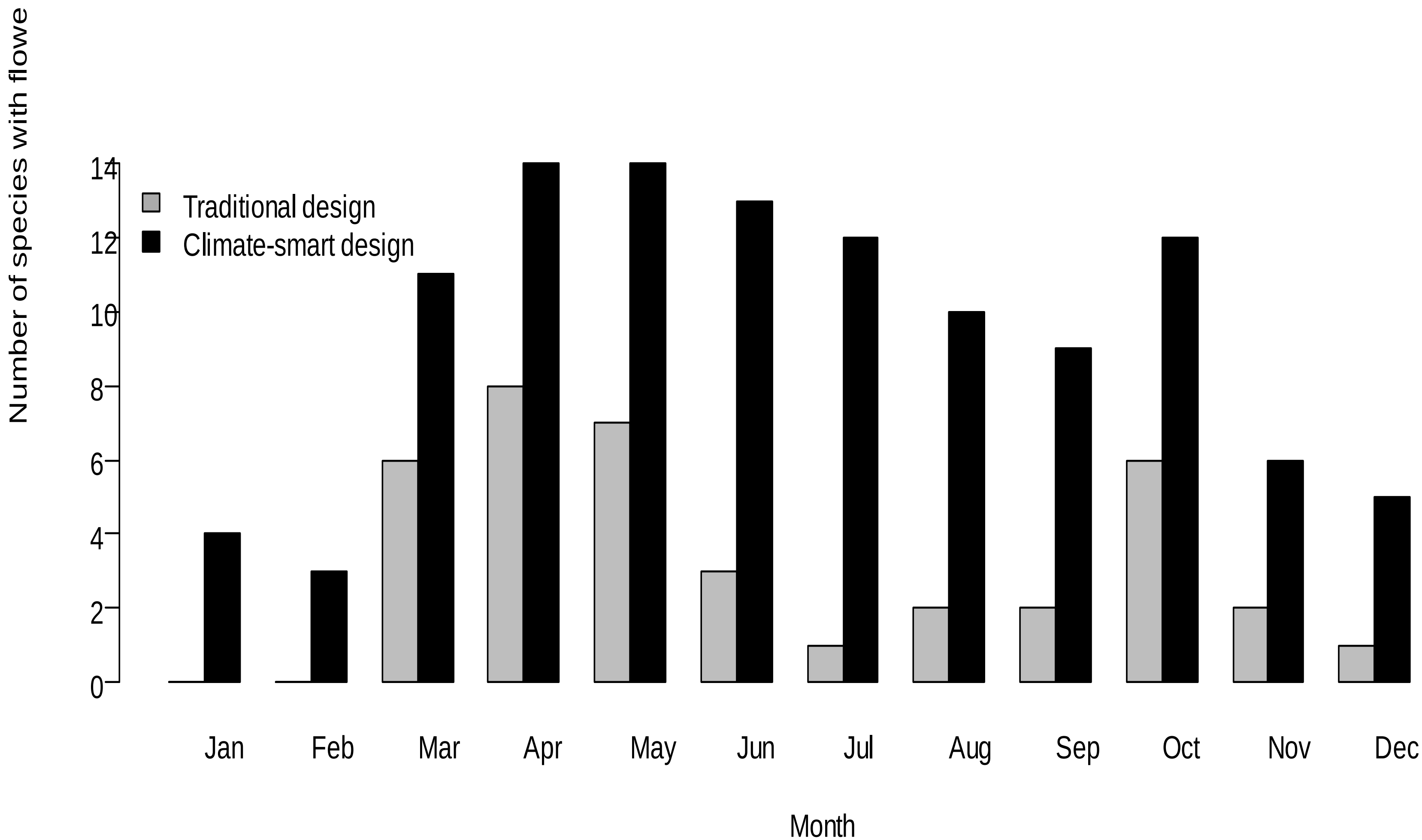
Implementation: Practices on-the-ground



Implementation: Practices on-the-ground

282 students and 82 parents

Climate-smart design: 24 species
Traditional design: 10 species

Planting more species required higher planting densities . . . .
Climate-smart: 249 individual plants
Traditional: 123 individuals plants

The cost of the climate smart restoration was only 1.5 times that of the traditional design, despite the higher densities and number of species.

Lessons Learned

- Species were not available from nurseries, limiting the final project's design
- A larger minimum project size is necessary for redundancy and self-propagation
- Potential regulatory challenges for projects with strict performance criteria
- There is a need to look beyond revegetation
- The public, planners, resource mangers, etc. are inspired and hungry to take actions to adapt to climate change

Next Steps

Science

- More case studies are needed
- New online tools such as analogue climates and planting designs
- Partnering with engineers – e.g., large woody debris projects
- Expanding our planting palette tool
- Working with a geneticist to include evolutionary resilience

Practice

- Additional habitat types
- Increase scale by expanding partnerships
- Restoration funders put language in their RFPs about how each project will address climate change in the context of our definition and principles.

Policy

- Work with the agencies that approve restoration plans to include climate-smart designs
- Work with agencies that provide guidance on restoration to include climate-smart designs
- Work with DFG to update their restoration handbook

Thanks!

Tom Gardali

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